

REMARKS

(A) STATUS OF THE APPLICATION

Applicants thank the Examiner for her explanation of the rejections in the Non-Final Office Action dated September 21, 2006.

(I) DISPOSITION OF CLAIMS

- (i) Claims 1, 3-6, 9 and 11 are pending in the application.
- (ii) Claims 2, 7, 8 and 10 have been canceled.
- (iii) Claims 1, 3-6, 9 and 11 are rejected under 35 U.S.C. § 103(a).

(II) APPLICANTS' ACTION

- (i) Applicants have amended Claim 1. The basis for amendment is found on Page 7, Lines 16-32, and Page 8, Lines 1-18 of the original specification.
- (ii) Applicants respond to the above rejections.

(B) RESPONSE TO REJECTION UNDER 35 U.S.C. 103(A)

(I) U.S. PATENT NO. 6,165,621 TO KASARI, ET AL. IN VIEW OF U.S. PATENT NO. 5,869,566 TO THOMAS-CLAIMS 1, 3-6, 9, & 11

Claims 1, 3-6, 9, and 11 have been rejected under 35 U.S.C. § 103(a) as obvious over U.S. Patent 6,165,621 to Kasari, *et al.* (*hereinafter* "Kasari") in view of U.S. Patent 5,869,566 to Thomas (*hereinafter* "Thomas").

In the Final Office Action the Examiner states that Kasari discloses a method of forming a 3-coat system for automotive applications. The method comprises the steps of applying the following to a metal substrate:

- (A) an organic solvent-based thermosetting metallic first base coating composition which comprises a metallic pigment,
- (B) an aqueous thermosetting second base coating compositions which comprises a metallic pigment or a coloring pigment, and
- (C) an organic solvent-based thermosetting clear coating composition. It is a thermosetting composition comprising a hydroxyl-containing acrylic resin, a crosslinking agent preferably amino resin and an organic solvent.

According to the Examiner, Kasari “fail[s] to teach that a solvent based clear coat composition containing hydroxyl containing film forming material and polyisocyanate crosslinking agents that cures at ambient temperature or in the range of 40°C to 60°C is used as a clear thermosetting composition. . .,” which, is an element of Claim 1 of the present application added by amendment in the last response to Office Action.¹

However, according to the Examiner, Thomas teaches a solvent-based clear coating composition containing hydroxyl group-containing polymer and a polyisocyanate curing agent that cures under ambient conditions or at slightly elevated temperatures by heating to a temperature ranging from about 30°C to 60°C, which is that element of Claim 1 that Kasari fail to teach. Therefore, according to the Examiner, Claim 1 (and dependent claims) of the present application is (are) obvious over Kasari in view of Thomas.

In response, and in order to expedite prosecution, Applicants have amended Claim 1, which now includes several available routes for drying and curing of (a) the solvent-based basecoat (b) the water-based basecoat, and (c) the clear organic solvent-based lacquer coat or clear water-based lacquer coat, at ambient temperatures or at temperatures in the range of 40°C to 60°C. The basis for the Claim 1 amendment is found on Page 7, Lines 16-32, and Page 8, Lines 1-18 of the original specification.

With the amendment, Claim 1 now additionally includes, *inter alia*, the element wherein the solvent-based basecoat, and/or the water-based basecoat are dried, or dried and cured at ambient temperatures or at temperatures in the range of 40°C to 60°C, and the clear coat is dried and cured at ambient temperatures or at temperatures in the range of 40°C to 60°C. In addition, Claim 1 also covers the scenarios (1) wherein the water-based basecoat is applied wet-on-wet on the solvent-based basecoat, (2) wherein just the clear coat (solvent- or water-based lacquer) is applied wet-on-wet on the water-based basecoat, and (3) wherein the water-based basecoat is applied wet-on-wet on the solvent-based basecoat, and the

¹ See Final Office Action, Page 3, Section 8, Paragraph 3.

clear coat (solvent- or water-based lacquer) is applied wet-on-wet on the water-based basecoat, and for all three scenarios, the drying and/or curing is accomplished at ambient temperatures or at temperatures in the range of 40°C to 60°C.

Clearly, with the proposed amendment in Claim 1, the present Claim 1 cannot be deemed obvious under the combination of Kasari and Thomas because neither Kasari, nor Thomas teach curing of the basecoats at ambient temperatures or at temperatures in the range of 40°C to 60°C. As acknowledged by the Examiner, Kasari fails to teach curing of either the basecoats or of the clear coats at ambient temperatures or at temperatures in the range of 40°C to 60°C. In fact, the curing temperatures in Kasari are 100°C and above, see for example, Col. 3, Lines 2-4, 140-210°C; Col. 3, Lines 24-25, 100-150°C; Col. 13, Lines 8-9, 175°C; Col. 13, Lines 19-20, 140°C; Col. 17, Lines 13-14, 140°C; and Col. 18, Lines 37-49, 140°C. The first basecoat, as well as the clear coat of Kasari, contain amino resins as hardener. Thus, curing takes place accordingly, generally in the range of 120°C to 180°C. The clear coat of the present invention, however, contain polyisocyanates as curing agents, which allow curing at lower temperatures.

Secondly, Thomas is directed to the use of two-pack (OH/NCO) clear coats. Thomas does not teach curing the basecoats at ambient temperatures or at temperatures in the range of 40°C to 60°C.

Therefore, Applicants respectfully submit that Claim 1 and by extension, the dependent claims, are not obvious over Kasari in combination with Thomas.

(II) U.S. PATENT 5,578,345 TO MOY IN VIEW OF U.S. PATENT NO. 6,165,621 TO KASARI, ET AL.-CLAIMS 1, 3-6, 9, & 11

The discussion on Kasari, supra, is incorporated herein by reference. Clearly, Kasari does not teach curing at ambient temperatures or at temperatures in the range of 40°C to 60°C.

According to the Examiner, however, although “Moy does not expressly teach that the first basecoat is organic solvent based and contains a solid pigment, the second basecoat is water based (Claim 1) and contains either metallic pigment (Claim 3) or solid color pigment (Claim 6),” it teaches, *inter alia*, that:

“All coatings are air dried (claimed curing at ambient temperatures) (See column 10, lines 18-35).” [Emphasis in the Examiner’s Office Action].

Applicants disagree with this construction of Moy offered by the Examiner in order to establish the *prima facie* case of obviousness. Applicants reproduce the cited section “column 10, lines 18-35” to clarify the error in the Examiner’s interpretation of this particular assertion in Moy.

The two solutions were sprayed over treated Bonderite 1000 panels and allowed to air dry for 2 hours. Film thicknesses were 1.4 mils (Solution 1) and 1.6 mils (Solution 2). [Emphasis added]

A clearcoat solution based on a hydroxy-functional acrylic resin was prepared. For each 80 g of clearcoat solution, 10 g of Desmodur.RTM. N-851 isocyanate and 40 g of reducing solvent were added. The solution was split into two solutions (Solutions A and B). 1.1 g of an 8% solution of zinc naphthenate was added to Solution B.

Each of Solutions A and B were sprayed over Solutions 1 and 2 to film thicknesses of 0.8 mils. The following dry time results were obtained:

Tack Free Times	Solution 1	Solution 2
Solution A	30 min	110 min
Solution B	30 min	90 min

First, the cited Example IV in Moy does not relate to basecoat, at all. The first coat that the Examiner assumes as a basecoat is in reality a primer surfacer. The second coat is the clear coat. In fact, Moy does not deal with a system having more than one basecoat at all, if that. See for example, Examples I and II of Moy. These Examples do not relate to a two basecoat system. In fact, Moy refers only to the following variants of coating systems (See, Col. 2, Lines 37-65):

1. a primer + top coating composition with hydroxy binder and NCO hardener;
2. a primer + base coating composition with hydroxy binder and NCO hardener;
3. a primer + pigmented basecoat + clear coat with hydroxy binder and NCO hardener;
4. a pigmented basecoat + clear coat with hydroxy binder and NCO hardener.

Clearly, Moy does not relate, at all, to two basecoat systems.

Addressing further, the issue of air drying for 2 hours, as cited by the Examiner from Col. 10, Lines 18-35, the phrase “air dry for 2 hours” does not mean that the primer surfacer was cured at ambient temperatures. It means that the coatings were dried at ambient temperatures in order to remove excess solvent from the coatings.

Initially, Moy prepared two solutions; Solution 1 and Solution 2, for the primer surface. In Solution 1, 10% dibutyl tin dilaurate in methyl ethyl ketone was added. Dibutyl tin dilaurate, according to Moy (See Col. 10, Lines 15-17), is a catalyst for curing purposes. No catalyst, i.e., dibutyl tin dilaurate, was added to Solution 2.

On reading further, it is clear that Moy, later, also prepared two clear coat solutions A and B. Nothing was further added to Solution A. However, an 8% solution of zinc naphthenate was added to solution B. Solution A was sprayed on both, a Solution 1-coated panel, and a Solution 2-coated panel. Solution B was also sprayed on both, a Solution-1 coated panel, and a Solution 2-coated panel. Data in the Table reflect the tack-free times, i.e., the time to cure these four samples. And they obviously do not correspond the “air dry[ing] for 2 hours” as suggested by the Examiner. If what the Examiner says is true, the samples would be cured only after 2 hours, no more, no less. In that case, the data in the table, all less than 2 hours, and different from each other, would have been meaningless.

Moy's invention relates to having a catalyst in the basecoat that is inert. Thus, it cannot have NCO groups, and therefore no curing can occur between hydroxy and the NCO groups. When the second coat (the clear coat) is applied, the catalyst migrates into the clear coat containing hydroxy binder and polyisocyanate, and catalyses the curing reaction. In other words, the “air dry[ing] for 2 hours,” is not, and cannot be the event related to curing.

The paragraph following the quotation by the Examiner, i.e., Col. 10, Lines 36-41, elaborates this further:

“As can be seen from above results, the incorporation of dibutyl tin laurate catalyst into a waterborne primer-surfacer can accelerate the cure rate of both an

**uncatalyzed isocyanate-containing topcoat and a
catalyzed isocyanate-containing topcoat.”**

Thus, the tabulated data must show the curing times. The “2 hours” quoted by the Examiner, therefore, must be the time in which the samples were dried under ambient air. Not cured.

Clearly, Moy does not teach curing at ambient temperatures, which negates the first prong of obviousness inquiry, i.e., the presence of all elements of the claim, and also the second prong, i.e., a suggestion or motivation to combine two references. Therefore, a *prima facie* case of obviousness is not established over Moy in view of Kasari, as suggested by the Examiner.

(III) U.S. PATENT NO. 6,291,018 TO DATILLO IN VIEW OF U.S. PATENT NO. 6,165,621 TO KASARI, ET AL., FURTHER IN VIEW OF U.S. PATENT NO. 5,869,566 TO THOMAS-CLAIMS 1, 3-5, 9, & 11

The discussion on Kasari and Thomas, *supra*, is incorporated herein by reference. Clearly, Kasari does not teach curing at ambient temperatures or at temperatures in the range of 40°C to 60°C. Similarly, Thomas does not teach curing of the basecoats at ambient temperatures or at temperatures in the range of 40°C to 60°C. It should be noted that with the amendment, Claim 1 now additionally includes, *inter alia*, the element wherein the solvent-based basecoat, and/or the water-based basecoat are dried, or dried and cured at ambient temperatures or at temperatures in the range of 40°C to 60°C, and the clear coat is dried and cured at ambient temperatures or at temperatures in the range of 40°C to 60°C (see *supra* for additional changes in Claim 1 as a result of the amendment).

Clearly, with the proposed amendment in Claim 1, the present Claim 1 cannot be deemed obvious under the combination of Kasari and Thomas because neither Kasari, nor Thomas teach curing of the basecoats at ambient temperatures or at temperatures in the range of 40°C to 60°C. U.S. Patent No. 6,291,018 to Datillo (hereinafter “Datillo”) does not teach this limitation either. Thus, at least prong 1 of the test for prima facie obviousness, i.e., all elements of a claim must be present in references, is not satisfied.

In the Non-Final Office Action dated May 19th, 2006 (paragraph 6 of which is incorporated herein by reference), the Examiner stated that Datillo discloses a method of forming multi-layer color-plus-clearcoating system for automotive applications. We do not disagree with this interpretation by the Examiner.

Next, the Examiner stated that both the first and the second basecoat materials of Datillo are liquid, preferably water-borne, coating materials. The Examiner also emphasized the word “preferably.”

We do not disagree with this interpretation by the Examiner, although we do respectfully submit that we do not find anything significant or relevant in the emphasis of the word “preferably,” to the interpretation proposed by the Examiner. Applicants believe that the word “preferably” used in Datillo means that Datillo uses:

- (1) two basecoats, **BOTH** of which are water-borne; or
- (2) two basecoats, **BOTH** of which are solvent-borne.

And the word “preferably” indicates Datillo’s inclination or preference to use a “two basecoats, both water-borne” system over “two basecoats, both solvent-borne” system. We arrive at this interpretation as a result of the following quote from Datillo in Col. 5, lines 59-62:

The second basecoat material contains **SIMILAR** components (such as film forming material and crosslinking material) to the first basecoat material but further comprises one or more effect pigments. Non-limiting examples of effect pigments useful in the practice of the invention include mica flakes, aluminum flakes,. . .[Emphasis added].

In other words, the distinction between the first and the second basecoats of Datillo **DOES** originate from the second basecoat having one or more effect pigments that are not found in the first basecoat. And that the distinction between the two basecoats of Datillo **DOES NOT** originate from the first basecoat being different to the second basecoat *to the extent* that one of them is solvent-borne basecoat and the other is a water-borne basecoat. If, in fact, the distinction between the first basecoat and second basecoat of Datillo did originate (and we know that it does not) from their chemical nature, i.e., one was a solvent-borne basecoat and the other was

a water-borne basecoat, Datillo would have stated as such, just as Datillo states that the distinction between the first basecoat and the second basecoat (*supra*, the indented paragraph above) originates from the presence and absence of pigments in otherwise similar basecoats.

The Examiner also stated that suitable film-formers for organic solvent-based basecoats are disclosed in U.S. Patent No. 4,220,679 to Backhouse (*hereinafter* "Backhouse") incorporated in Datillo by reference. The Examiner emphasized the term "organic solvent-based basecoats." The Examiner interpreted this statement to mean that organic solvent-based basecoats are not excluded in Datillo. Again, the Examiner emphasized the term "organic solvent" and the word "not."

We do not disagree with this interpretation by the Examiner, although we do respectfully submit that we do not find anything significant or relevant in the emphasis of the terms "organic solvent-based basecoats," and "organic solvent" or the word "not," to the interpretation proposed by the Examiner.

However, from the above logic, the Examiner then drew the conclusion that Datillo teaches that "any combination of organic solvent-based basecoats and water-borne basecoats can be used" including the "claimed combination" of the present application. We disagree with the interpretation and hence the conclusion.

We respectfully submit that Datillo does not teach a solvent-borne basecoat **AND** a water-borne basecoat within the context of the above discussion. Datillo expressly states that its first basecoat and the second basecoat are similar except for the presence of the pigment in the second basecoat. For example, in Col. 15, Example 1, Datillo teaches using a first basecoat, which is a water-borne basecoat DHWB 74101 from PPG Industries, without the metallic effect pigment, and the second basecoat is the same water-borne basecoat DHWB 74101 from PPG Industries, WITH the mica flake and aluminum flake effect pigments (See Col. 15, lines 20-25).

Simply because Datillo discusses using two water-borne basecoats OR two solvent-borne basecoats does not, and can not, lead one to conclude that a water-borne AND a solvent-borne basecoats are also implicated for use. Such conclusion cannot

be drawn from even a logical standpoint, even if a reference to two water-borne basecoats and two solvent-borne basecoats were (and are) made in the same art, particularly in face of the fact that the difficulty of using a water-borne basecoat with a solvent-borne basecoat is well-known in art.

Applicants, in fact, have overcome this particular difficulty by way of this invention that provides a method for creating a water-borne basecoat in contact with a solvent-borne basecoat and in accordance with the industry-mandated standard.

Moreover, the Datillo process is used in original coating of vehicles. For example, Claim 1 of Datillo uses a bell applicator ; a typical applicator used in OEM coating. On the other hand, the present application relates to refinishing of substrates. (See "Title of Invention").

Finally, the curing temperatures used in Datillo are for example, 141°C, also typical for OEM. The aim in Datillo is to provide a process with controlled evaporation rate at spray, which is completely different from that of the present invention. With the current amendment, the present invention has the curing temperatures at the ambient or at temperatures in the range of 40°C to 60°C.

Therefore, even when Kasari, Thomas and Datillo are combined, as suggested by the Examiner, all elements of Claim 1, and by extension, the dependent claims are not found within the prior references. From the above arguments, Applicants respectfully submit that Claims 1, 3-5, 9 and 11 are not obvious under 35 U.S.C. § 103(a) .

(IV) U.S. PATENT NO. 6,165,621 TO KASARI, IN VIEW OF U.S. PATENT 5,578,345 TO MOY, FURTHER IN VIEW OF U.S. PATENT NO. 6,291,018 TO DATILLO-CLAIMS 1, 3-5, 9, & 11

The discussion on Kasari in B(I), supra, is incorporated herein by reference. Kasari does not use or disclose curing temperatures that are at the ambient or in the temperature range of 40°C to 60°C. Kasari's curing temperatures are 100°C and above.

The discussion on Moy, in B(II), *supra*, is incorporated by reference herein. Moy does not teach curing at ambient temperatures or in the temperature range of 40°C to 60°C. Moy, in fact, does not specify curing temperatures.

The discussion on Datillo from B(III) above is incorporated herein by reference. Clearly, Datillo neither teaches simultaneous solvent-based and water-based basecoats, nor does it teach curing at ambient temperatures or at temperatures in the range of 40°C to 60°C.

Because the references when combined do not teach all elements of Claim 1 of the present application, and because there is no motivation or suggestion to combine (even if they taught all the limitations, which they do not), Applicants respectfully submit that the Examiner has failed her burden to establish the *prima facie* case of obviousness. Therefore, Claims 1, 3-5, 9 and 11 are not obvious under 35 U.S.C. § 103(a).

(V) U.S. PATENT NO. 6,592,999 TO ANDERSON, *ET AL.* IN VIEW OF U.S. PATENT NO. 5,869,566 TO THOMAS-CLAIMS 1, 3-6, 9, & 11

Claims 1, 3-6, 9 and 11 have been rejected under 35 U.S.C. § 103(a) as obvious over U.S. Patent 6,592,999 to Anderson, *et al.* (*hereinafter* "Anderson") in view of Thomas.

Applicants traverse for the following reasons.

Applicants respectfully disagree with the Examiner's reasoning of obviousness under 35 U.S.C. § 103(a) with reference to Anderson. Section 2142 of the MPEP indicates that a *prima facie* case of obviousness is established only when:

- (1) all of the claim limitations are either taught, or suggested by the cited prior art;
- (2) there is some suggestion or motivation to modify or combine the cited prior art references; AND

- (3) there is a reasonable expectation of successfully producing the claimed invention via such a combination.

Section 2143 of the MPEP further explains that “[t]he teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not in applicant’s disclosure.”

Applicants respectfully assert that because neither of the three prongs set forth in the above test are satisfied, a *prima facie* case of obviousness is not established.

First, Applicants’ method is directed to the refinishing of multi-coated substrates. In the Office Action dated July 26, 2005 (to which the Examiner refers to in the present Office Action via the May 19, 2006 Office Action), on page 4, first full paragraph, the Examiner states that “[c]learly, all three-layer coatings can be used for refinishing because of interlayer adhesion between any of the layers,. . .” However, Anderson does not disclose, at any place, a multi-layer coating comprising a primer and/or a primer surfacer (filler), a first solvent-based basecoat, a second aqueous basecoat and a solvent-based or aqueous clearcoat.

In fact, Applicants’ process requires the application of two basecoats whereas Anderson applies a primer and a basecoat.

The Examiner disagrees to this assertion (originally made in our response to the Office Action of July 26, 2005) with regards to Anderson, and states to the contrary that “Anderson teaches **expressly** that the process requires the application of **two basecoats**. **Therefore, Applicants’ statement that Applicants process requires the application of two basecoats whereas Anderson applies a primer and a basecoat is incorrect.**” (Emphasis in the original).

Applicants respectfully disagree to this construction offered by the Examiner. Anderson does not, either expressly or implicitly, teach a process that requires TWO basecoats. Applicants reiterate their assertion that Anderson applies a primer and ONE basecoat AND NOT TWO basecoats.

In fact, we reproduce the original wording the Examiner refers to from Anderson, below:

"The test panels, pre-coated with an **electrocoat primer** commercially available from PPG Industries; Inc., as ED5000 were coated with a primer/surfacer and a basecoat by spray application to a film thickness of 1.1 mils (27.9 microns) and 0.6 mils (15.2 microns) respectively, with **gray solvent-borne primer** commercially available from Akzo-Nobel Corp., and a **water-borne silver basecoat**. . . available from Solutia. . ."

"The basecoat panels were then flashed 10 minutes at 176° F. (80° C.) before electrostatically applying the **powder clearcoating compositions**..." (Emphasis added).

Clearly, the multilayer coating of Anderson comprises:

1. pre-coated electrocoat primer;
2. gray solvent-borne primer/surfacer from Akzo;
3. water-borne silver basecoat from Solutia; and
4. powder clearcoat.

Applicants respectfully point out that the mention of "basecoat" in the above paragraph, occurring twice, refers to the same layer. In the first instance, "basecoat" is mentioned to indicate that the basecoat was applied by spray application. In the second instance, "basecoat" is mentioned to indicate that such a basecoat is water-borne and that such a basecoat was obtained from Solutia, Inc. Applicants respectfully submit that a reference to the term "basecoat" in the above paragraph, although made twice, does refer to only ONE basecoat that which is spray-applied, that which is water-borne, and that which is obtained from Solutia, Inc.

Furthermore, the gray solvent-borne primer can not be seen as a solvent-borne basecoat. To a person skilled in the pertinent art, a primer or a primer surfacer and a basecoat are two different elements, necessarily distinct serving different functions in the automotive finish related art (See discussion, *infra*).

The discussion on Thomas in B(I), *supra*, is incorporated here in by reference. Thus, it is clear that all of the claim limitations are neither taught nor suggested by Anderson in view of Thomas. Therefore, the first prong of the obviousness inquiry is not satisfied.

The present invention uses solvent- or water-based clearcoats instead of powder clearcoats as used in Anderson.

Further, the Examiner states that Anderson shows a method for forming multi-layer coatings that have improved interlayer adhesion. In the method of Anderson, on the primer-precoated substrate, a primer/surfacer and a gray solvent-borne primer are applied by spray application. A water-borne silver basecoat (claimed metallic effect pigment basecoat) is applied on said primer. A powdered clear coating is then applied. The interlayer adhesion of the coatings is improved by the inclusion of adhesion promoters. The Examiner states that such a multi-layer coating could be used for automotive refinishing.

Applicants respectfully submit that the teachings of the entire Anderson reference should be considered, and not just convenient portions, for an obviousness inquiry. Anderson's invention is directed to solving the problem of intercoat adhesion of various layers in a multi-layer coating. Applicants' invention is directed to solving an entirely different problem from that set forth by Anderson. As stated above, Anderson solved an interlayer adhesion problem. Applicants, on the other hand, address the problem of reducing solvent emissions of a refinish coating system. As is well-known, VOC (volatile organic content) of paints is regulated depending upon the paint usage. To reduce such emissions, water-based coating compositions can be used. However, when relatively thick water-based coatings are used for a basecoat layer (generally 40 microns and above), the resulting coating has a poor visual appearance. However, such higher thickness levels of basecoats are needed for coatings that have poor masking ability.

Applicants' solution to this problem is to use two basecoat layers, the first being a solvent-borne basecoat and the second a water-borne basecoat. When this combination of basecoats is top-coated with a lacquer clear-coating, a multi-layer finish is formed having an excellent appearance and superior physical properties. This is clearly illustrated in the Examples section of present application.² Example 1 shows a multi-layer coating formed according to the process of this invention utilizing

² See pages 10-11 of the specification of the present application.

a first solvent-borne basecoat layer and a second water-borne basecoat layer top-coated with a clear lacquer. Example 2 shows a multi-layer coating, but only with a water-borne basecoat and a clear lacquer top-coat. The Table on page 11 of Applicants' specification shows a comparison of the coated panels of Examples 1 and 2 wherein the appearance, gloss, flow, and hardness of Example 1 (the invention) are significantly better than the use of only a water-borne basecoat layer (Example 2), which is a surprising and unexpected result. The use of only water-borne basecoat instead of a combination of a solvent-borne and a water-borne (in comparable layer thicknesses) has disadvantages regarding e.g., topcoat quality and masking capacity. Especially the problem regarding masking capacity in a repair coating process is not mentioned in Anderson. Thus, Applicants have accomplished both a reduction of VOC and have improved the appearance and physical properties of the multi-layer finish with their claimed process. This certainly has not been taught or suggested by Anderson. Therefore, the second prong of the obviousness inquiry, outlined above, is not satisfied.

Further, in the Office Action, the Examiner has equated a primer and primer/surfacer to a basecoat. Applicants respectfully assert that a hypothetical person skilled in the pertinent art would not interpret a primer and/or a primer/surfacer as same as a basecoat. Primers or primer/surfacer and basecoats are distinct and serve entirely different purposes in a multi-layer coating system.

To further accentuate this point, Applicants have provided the following documents for the Examiner's review:

- (1) **Automotive and Coatings, Edited by G. Fettis, VCH publication (1st Edition), pp 120-121, and**
- (2) **Ullmann's Encyclopedia of Industrial Chemistry (5th Edition, Vol. A, pp 517-519).**

In the Automotive Paints and Coatings document, various layers of a typical multi-layer automotive coating are set forth and identified. Fig. 5-1 pictorially shows the various layers and in particular, the primer layer, the primer/surfacer layer, the basecoat layer and topcoat layer. The primer/surfacer layer fills in voids and provides a smooth surface that can be sanded, if necessary. However, this layer does not provide color to the resulting multi-layer finish. As shown in Anderson, this

is the gray layer. The basecoat layer is the color-providing layer of the multi-layer coating. The basecoat layer is not sanded or treated in any manner but is top-coated with a clear protective layer. Thus, each of the layers of a multi-layer coating have a special purpose and are significantly different from each other.

Similarly, Ullmann's Encyclopedia discusses multi-layer automotive paint coatings comprising primers, intermediate coats (also called fillers or surfacers) and topcoats comprising a basecoat and a clear coat. This combination is the most popular topcoat used on automobiles today. The topcoat provides a full, deep gloss (wet look), high-brilliance metallic effects, long-lasting chemical and weathering resistance, and ease of polishing and repair. Thus, the purpose of a topcoat comprising a basecoat/clear coat combination is very different from that of the primer surfacer layer.

However, the Examiner, in the present Office Action (by virtue of incorporation of the Office Action of May 19, 2006, further incorporating the Office Action of July 26, 2005) equates the gray solvent-borne primer to a basecoat. As pointed out previously, these are two different layers not functionally or structurally interchangeable.

Arguably, and although not actually supported by the Anderson reference if the gray solvent-borne primer/surfacer were applied first as suggested by the Examiner, followed by the water-borne basecoat, a multi-layer composition of Example 2 of Applicants' specification would result. And to provide an adequate concealment of the gray solvent-borne primer/surfacer, an extra-thick coating of the water-borne basecoat would have to be applied. As shown in the comparative Example 2, this results in inferior appearance and physical properties of the multi-layer coating when compared to the invention that is set forth in Example 1. There is no teaching or suggestion in Anderson to provide for two layers of basecoat, the first, a pigmented solvent-based coating layer and the second, a water-based coating layer as required by the present Application. Thus, there is NO reasonable expectation of successfully producing the claimed invention via such a combination as suggested by the Examiner. The third prong of the obviousness inquiry is also not satisfied.

Finally, the Examiner cites references that allegedly use primer and basecoat interchangeably. However, the alleged interchangeable use in prior art references is only based on the fact that own definitions have been used in the references, e.g. in U.S. Patent No. 4,720,403 to Jasenof two primer layers have been used, wherein the first layer has been defined as a basecoat and the second layer as an overcoat. This definition has been used to distinguish between the two primer layers and does not effect general definitions/general knowledge in the art. The basecoat and the overcoat in Jasenof are still primers and do not function as a pigmented basecoat which provides the substrate with a desired color or effect a basecoat usually does. Also in U.S. Patent No. 5,612,093 to Braig and U.S. Patent No. 4,619,746 to Delaney definitions have been used for primers, e.g. basecoat or undercoat in Braig and electrophoretically applied basecoat in Delaney. But it is obvious from the context of the several teachings that the layers are still primer layers according to their function in automotive coatings.

Therefore, the obviousness rejection based on Anderson and Thomas can not stand and should be withdrawn and the claims allowed.

(VI) U.S. PATENT NO. 6,592,999 TO ANDERSON, ET AL., IN VIEW OF U.S. PATENT NO. 5,869,566 TO THOMAS, FURTHER IN VIEW OF U.S. PATENT NO. 5,073,370 TO KUBITZA ET AL., AND U.S. PATENT NO. 5,466,286 TO BRISELLI, ET AL.-CLAIM 4 & 5

Claims 4 and 5 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Anderson, in view of Thomas, further in view of U.S. Patent No. 5,075,370 to Kubitza, *et al.* (*hereinafter* "Kubitza"), and U.S. Patent No. 5,466,286 to Briselli, *et al.* (*hereinafter* "Briselli").

The discussion from B(I) on Thomas and on Anderson and Thomas from B(V), *supra*, is incorporated herein by reference. Neither Thomas, nor Kubitza, nor Briselli, nor the combination of these patents make up for the many deficiencies of Anderson.

Specifically, the Examiner states (in the May 19, 2006 Office Action) that although Anderson fails to teach that the solvent-borne primer is a two-component coating

composition, Kubitza teaches that “organic solvent based two-component polyurethane paints. . .are extensively used in the coating field.” Therefore, according to her, “[i]t would have been obvious to one of ordinary skill in the art at the time the invention was made to have used organic solvent based two-component polyurethane paints. . .as solvent-borne two-component primer in Anderson. . .”

Applicants would like to point out that Applicants’ Claims 4 and 5 are directed to basecoats AND NOT TO primers. Also, as pointed out *supra*, as understood by a person of ordinary skill in the pertinent art, a primer is distinct from a basecoat. And not only that. They also serve different functions. Primers are NOT basecoats and are not considered as interchangeable. Kubitza merely discloses that polyisocyanates can be used in coatings. Applicants’ process for forming a multi-layer coating wherein the basecoat is a two-layer basecoat of (1) a solvent-borne basecoat, and (2) a water-borne basecoat, is not even mentioned. Applicants respectfully submit that combining Kubitza with Anderson is not relevant to Claims 4 and 5 of their invention. And to that end, Applicants respectfully disagree as to the alleged obviousness of their invention.

Similarly, Briselli shows a single water-borne basecoat being applied to a two-component polyurethane primer/surfacer. As pointed out previously, in the pertinent art, a primer is not a basecoat and even a primer/surfacer is not a basecoat. Therefore, all of the claim limitations are not taught in the references, i.e., prong I of obviousness inquiry not satisfied.

Secondly, the references do not provide any motivation to combine the references, and in fact such combination may not even be relevant. Finally, as pointed out *supra*, even if arguably such a combination were made (without any motivation or incentive to combine of course), such a combination will not have any reasonable expectation of success. Comparative Example 2 of the Applicants’ disclosure bears testimony to this failure, in fact. Example 2 shows the inferior result both in appearance and in physical properties, when only one basecoat was used, as suggested by the Examiner.

Applicants respectfully submit that a *prima facie* case of obviousness is not established as a result. Therefore, the rejection based on the above combination of references can not stand and should be withdrawn and the claims allowed.

(VII) U.S. PATENT NO. 6,592,999 TO ANDERSON, ET AL., IN VIEW OF U.S. PATENT NO. 5,869,566 TO THOMAS, FURTHER IN VIEW OF U.S. PATENT NO. 5,073,370 TO KUBITZA ET AL., U.S. PATENT NO. 5,466,286 TO BRISELLI, ET AL. AND U.S. PATENT NO. 5,976,343 TO SCHLAACK-CLAIM 6

Claim 6 was rejected under 35 U.S.C. § 103(a) over Anderson, in view of Thomas, further in view of Kubitza, Briselli and U.S. Patent No. 5,976,343 to Schlaak (*hereinafter* "Schlaak"). The many deficiencies of Anderson, Thomas, Kubitza and Briselli have been pointed out above and will not be repeated. As for Schlaak, it does not overcome the deficiencies of these references even if combined therewith, although no such combination is suggested by Schlaak.

Schlaak adds nothing to the teaching of the already cited patents. Schlaak merely states that primers can contain crosslinking agents and a variety of pigments and can be topcoated with water based color and/or effect-providing lacquers and that color-providing pigments can be used in these lacquers. There is no teaching or suggestion of Applicants' invention of using two basecoats, a solvent-borne basecoat and a water-borne basecoat, and finally coating with a clear lacquer to form a multi-layer coating. As discussed previously, this gives a significantly better appearance and physical properties in comparison to multi-layer coating that only uses a water-borne basecoat, as taught by Schlaak.

Therefore, again, as the *prima facie* case for obviousness is not established, the rejection of Claim 6 based on the above combination of references should be withdrawn and the claim allowed.

CONCLUSION

In view of the above remarks, Applicants respectfully submit that stated grounds of rejection have been properly traversed, accommodated, or rendered moot and that a complete response has been made to the Final Office Action mailed on September 21, 2006.

Therefore, Applicants believe that the application stands in condition for allowance with withdrawal of all grounds of rejection. A Notice of Allowance is respectfully solicited. If the Examiner has questions regarding the application or the contents of this response, the Examiner is invited to contact the undersigned at the number provided.

Should there be a fee due which is not accounted for, please charge such fee to Deposit Account No. 04-1928.

Respectfully Submitted,

By:

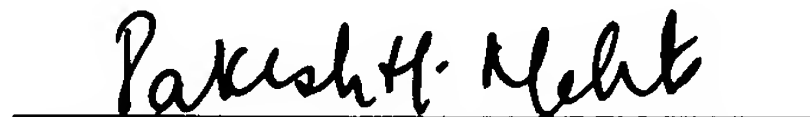
Date: December 11, 2006



HILMAR L. FRICKE, ESQUIRE
ATTORNEY FOR APPLICANTS
REGISTRATION No.: 22,384
PHONE: 302-984-6058
FAX: 302-658-1192

By:

Date: December 11, 2006



RAKESH H. MEHTA, ESQUIRE
ATTORNEY FOR APPLICANTS
REGISTRATION No.: 50,224
PHONE: 302-984-6089
FAX: 302-658-1192

Automotive Paints and Coatings

Edited by Gordon Fettis

Best Available Copy



Weinheim · New York · Basel · Cambridge · Tokyo

1995

Professor Gordon Fentis
Department of Chemistry
The University of York
Heslington
York YO1 500
United Kingdom

This book was carefully produced. Nevertheless, authors, editor and publisher do not warrant the information contained therein to be free of errors. Readers are advised to keep in mind that statements, data, illustrations, procedural details or other items may inadvertently be inaccurate.

1st edition 1995

Published jointly by
VCH Verlagsgesellschaft, Weinheim (Federal Republic of Germany)
VCH Publishers, New York, NY (USA)

Editorial Director: Dr. Barbara Böck, Louise Elamm
Production Manager: Dipl. Wirt.-Ing. (FH) Bernd Riedel

Library of Congress Card No. applied for.

A catalogue record for this book is available from the British Library

Die Deutsche Bibliothek - CIP-Einheitsaufnahme

Automotive paints and coatings / ed. by Gordon Fentis. -
Weinheim ; New York ; Basel ; Cambridge ; Tokyo : VCH, 1995
ISBN 3-527-28637-3
NE: Fentis, Gordon [Hrsg.]

© VCH Verlagsgesellschaft mbH, D-69451 Weinheim (Federal Republic of Germany), 1994

Printed on acid-free and low-chlorine paper

All rights reserved (including those of translation into other languages). No part of this book may be reproduced in any form - by photoprinting, microfilm, or any other means - nor transmitted or translated into a machine language without written permission from the publisher. Registered names, trademarks, etc. used in this book, even when not specifically marked as such, are not to be considered unprotected by law.

Composition: Mitterweger Werkstatt GmbH, D-68723 Plankstadt
Printing: Strauss Offsetdruck, D-69509 Mörlenbach
Bookbinding: Wilt. Oetwald & Co, D-67408 Neustadt
Printed in the Federal Republic of Germany.

5 Topcoats for the Automotive Industry

U. Poth

5.1 Definitions

Topcoats have as their main target to provide stability of the coating system against mechanical and chemical attack and to build an appealing effect. To fulfill all these aims, topcoats can consist of different layers. Whereas the traditional, so called solid colour topcoats consists of only one layer, today most of the metallic topcoats consist of two layers, the metallic basecoat and a clearcoat. Based on the experience with this two-layer system, there is a trend to apply solid colour topcoat systems in two layers as well. For special high quality topcoat systems there is the use of a solid colour precoat, which is applied before the topcoat to provide optimum smoothness and colour appearance. Usually, for the application of automotive coating systems there are three stoving processes: for the primer, the primer surfacer and the topcoat system. In the case of using a solid colour precoat four stoving times are required.

While the layer of primers for automotive coatings have a thickness of 18–23 μm (0.71–0.91 mils), the layer of primer surfacers have approx. 35 μm (1.38 mils), the solid colour topcoats have ca. 40 μm (1.57 mils), the metallic basecoats have 12–15 μm (0.47–0.59 mils) and the clearcoats have approx. 40 μm (1.57 mils), see Figure 5.1 [5.1].

Repair coats [5.2] are used for cars after any damage to the car body or in the case when an old coating system is no longer good in appearance or resistance. Repair coating systems consist of primers, primer surfacers, topcoats (in the special meaning of solid colour topcoats), basecoats and clearcoats ('after market repair'). The main difference between the OEM systems and the repair coats is the application method and more specifically the film building conditions. While the OEM topcoats will be stoved after spray application in tunnel ovens at temperatures of 120–150 °C (248–302 F) to build films with optimum properties, repair topcoats have to build resistant coat films at ambient temperatures or possibly at temperatures up to 60 °C (140 F). Therefore, the contents of repair coats are different to those of OEM coat systems.

If this damaging occurs during the coating process in the application line, the quality controller in the car plant can decide to run a repair coat application for a small part of the car or for the total car body. In the latter case the repair coat application will run under the same conditions as in the first coating process ('high-bake-repair' on line). If any damage to the coated car body is observed in a later state of the car construction and it is necessary to repair the coating system, the application of a repair coat runs always at temperatures about 80–90 °C (176–194 F). For this so called 'low-bake-repair' a special coating system has to be used.

Solid colour	Metalls
Solid colour topcoat approx. 40 μm (1.57 mils)	Clearcoat approx. 40 μm (1.57 mils)
	Basacoat 12 - 15 μm
Primer/surfacer approx. 35 μm (1.38 mils)	
Electrocoat primer 18 - 23 μm (0.71 - 0.91 mils)	
Substrate: steel and inhibition layer	

Figure 5-1. Layers of automotive coating systems.

Additionally there is an increase of the use of plastic parts in the construction of car bodies.

Coatings for plastic parts are quite different from those for the steel parts of a car body (see Chapter 6). Plastic parts can not be heated to higher temperature without loss of properties. Therefore topcoats for these parts are applied separately from the car body and the conditions of film building are at lower temperatures, normally 60–80 °C (140–176 F) in some special cases higher (max. 120 °C, 250 F) [5.3]. Therefore topcoats for plastic parts are related to repair topcoats, but one has to achieve a much higher flexibility for this type of topcoat.

5.2 The Development of the Different Automotive Topcoat Systems [5.4] (see Chapter 1)

The coating materials of the first cars consisted of air drying binder systems based on vegetable oils and resins: rosin and copals. Copals are semifossil resins of trees which grew in the tropics [5.5]. In England, this coating technology, based on the combination of vegetable oils and copals in a hot blend process, was developed to a high quality. For the coating process 20 separately painted coat layers are required and up to 3 weeks work time. In the twenties the demand for automotive cars increased rapidly and production assembly lines were invented and developed. Topcoats based on cellulose nitrate as a film building vehicle were used. Cellulose nitrate was combined with plasticisers, and the coating systems which consisted of this combination performed fast drying at ambient conditions and had good appearance [5.6].

Ullmann's Encyclopedia of Industrial Chemistry

Fifth, Completely Revised Edition

Volume A 18:

Nucleic acids to Parasympatholytics and
Parasympathomimetics

Editors: Barbara Elvers, Stephen Hawkins, Gail Schulz

HERBERTS
Labor-Bibliothek

Inventar-Nr. 1



1991

Numerical data, descriptions of methods or equipment, and other information presented in this book have been carefully checked for accuracy. Nevertheless, authors and publishers do not assume any liability for misprints, faulty statements, or other kinds of errors. Persons intending to handle chemicals or to work according to information derived from this book are advised to consult the original sources as well as relevant regulations in order to avoid possible hazards.

Production Director: Maximilian Montkowski
Production Manager: Myriam Nothacker

Editorial Assistants: Ilse Bodrich, Helen Goltz, Reinhilde Gutsche, Monika Pikart-Müller, Philomena Ryan-Bugler

Library of Congress Card No. 84-25-829

Deutsche Bibliothek, Cataloguing-in-Publication Data:

Ullmann's encyclopedia of industrial chemistry / ed.: Barbara Elvers ... [Ed. advisory board Hans-Jürgen Arpe ...]. — Weinheim ; Basel (Switzerland) ; Cambridge ; New York, NY : VCH.

Teilw. executive ed.: Wolfgang Gerhartz

Bis 4. Aufl. u. d. T.: Ullmanns Enzyklopädie der technischen Chemie

NE: Gerhartz, Wolfgang [Hrsg.]; Elvers, Barbara [Hrsg.]: Encyclopedia of industrial chemistry

Vol. A. Alphabetically arranged articles.

18. Nucleic acids to parasympholytics and parasymphomimetics. — 5., completely rev. ed. — 1991

ISBN 3-527-20118-1 (Weinheim...)

ISBN 0-89573-168-1 (New York)

British Library Cataloguing in Publication Data

Ullmann's encyclopedia of industrial chemistry.

18. Nucleic acids to parasympholytics and parasymphomimetics

1. Industrial chemistry

I. Elvers, Barbara II. Rounsaville, James F. III. Schulz, Gail

661

ISBN 3-527-20118-1

© VCH Verlagsgesellschaft mbH, D-6940 Weinheim (Federal Republic of Germany), 1991.

Printed on acid-free paper

Distribution

VCH Verlagsgesellschaft, P.O. Box 10 11 61, D-6940 Weinheim (Federal Republic of Germany)

Switzerland: VCH Verlag-AG, P.O. Box, CH-4020 Basel (Switzerland)

Great Britain and Ireland: VCH Publishers (UK) Ltd., 8 Wellington Court, Wellington Street, Cambridge CB1 1HZ (Great Britain)

USA and Canada: VCH Publishers, Suite 909, 220 East 23rd Street, New York NY 10010-4606 (USA)

All rights reserved (including those of translation into other languages). No part of this book may be reproduced in any form — by photoprint, microfilm, or any other means — transmitted or translated into a machine language without written permission from the publishers.

Authorization to photocopy items for internal or personal use, or the internal or personal use of specific clients, is granted for libraries and other users registered with the Copyright Clearance Center (CCC) Transactional Reporting Service, provided that the base fee of \$1.00 per copy, plus \$0.25 per page is paid directly to CCC, 27 Congress Street, Salem, MA 01970. 0740-9451/85 \$1.00 + 0.25.

Registered names, trademarks, etc. used in this book and not specifically marked as such are not to be considered unprotected.

Cover design: Wolfgang Schmidt

Composition, printing, and bookbinding: Graphischer Betrieb Konrad Tritsch, D-8700 Würzburg

Printed in the Federal Republic of Germany

and second primers prevent corrosion of the metal surface. The pigments and extenders allow the primers to react with ions (Cl^- and SO_4^{2-}) that diffuse into the film from the atmosphere. The pigmented organic film also forms a barrier against humidity that may otherwise initiate a corrosive process.

Heavy-metal pigments (mainly lead pigments) and zinc chromates were used successfully in earlier decades. These pigments are now being replaced by nontoxic pigments (see Section 11.3.1, and \rightarrow Pigments Inorganic).

The first and second topcoats build up the necessary dry film thickness and protect the entire coated construction against the adverse influence of the atmosphere.

Binders based on linseed oil and other oils have been used for many years in anticorrosive primers. Alkyd binders, especially those with high fatty acid contents, perform similarly. The main disadvantages of these binders is their limited chemical resistance and their slow drying.

Chlorinated rubber and poly(vinyl chloride) (PVC) resins allow the formulation of coatings with good chemical resistance. They are therefore used for steel constructions in chemical plants. Since they are not resistant to many organic solvents, they should not be used in oil refineries or plants handling solvents. The undesirable fact that these binders contain halogens in high amounts is responsible for their decreasing use. Overspray of chlorinated rubber and PVC paints and contaminated blasting materials produced after removing old paint cause severe problems in waste incineration plants (generation of hydrochloric acid), as well as in waste disposal areas (pollution of soil and water).

Epoxy resins cured with aminoamide resins or amine adducts are often used for large metal constructions. Paints based on these resins are normally applied in four layers. Epoxy coatings form films that are resistant to organic solvents and a wide range of chemicals. Epoxy coatings are currently used for the majority of steel and aluminum constructions, but are also suitable for use on other construction materials (e.g., concrete). They can protect buildings in chemical plants and nuclear power plants. Epoxy coatings are less susceptible to deterioration by radiation than other organic films, and are also resistant to decontaminating chemicals (usually aqueous detergent solutions) used to remove radioactive dust from walls and other surfaces in nuclear power plants.

Heat-resistant coatings have silicone-resin binders. Pigments for such paints are zinc dust, flakes of aluminum or stainless steel, titanium dioxide, or silicon carbide. Such paints can withstand temperatures up to 600°C .

Paints with inorganic binders are also used for corrosion protection of steel constructions. These paints are based on organic silicates which are soluble in mixtures of alcohols or other water-miscible solvents (see Section 2.15.2). Ethyl silicate is often used and mostly pigmented with zinc dust. Zinc-rich primers and single coats are available as one- or two-pack products. Zinc-rich ethyl silicate paints dry to form inorganic films that are very durable even under adverse atmospheric conditions, (e.g., onshore and at sea). These coatings have excellent resistance to oil, solvents, and mechanical impact, and are therefore used on drilling stations, oil rigs, and ships. Since zinc-rich silicate coatings are heat resistant, they are also used in hot areas of iron works, coal mines, and coking plants.

Heavy-duty coatings are often still applied manually with brushes or rollers that completely wet the metal surface; holes and pores are filled with paint. This is especially important when old, partially rusted constructions are repainted after sanding. Brushing and rolling, however, only allow a slow working speed. Larger surface areas must be painted with airless spraying equipment.

11.2. Automotive Paints

11.2.1. Car Body Paints

Cars are coated to achieve maximum, long-lasting corrosion resistance. Cars must also be given an optimum appearance that lasts for many years. Long-lasting color and gloss retention as well as resistance against cracking (especially in clearcoats of two-coat metallics) are therefore necessary. Topcoats of automobiles must withstand solar radiation and atmospheric pollution (e.g., acid rain and soot from oil combustion). Aggressive chemicals (e.g., road salts and cleaning agents containing detergents) can damage the coating if they come into contact with the car surface. Furthermore, small stones cause heavy impact on automobile surfaces and corrosion via chipping.

Large numbers of cars are manufactured on fast-running assembly lines. The paints must

therefore be applied with highly efficient equipment, and must dry very quickly. The paint products are classified as primers, intermediate coats (also called fillers or surfacers), and topcoats (or finish). The primers and fillers are designated as the undercoating system.

Car paints are cured with heat in special oven lines. Electrodeposition coatings (used as anticorrosive primers) contain only small amounts of volatile organic compounds (VOC), whereas intermediate and topcoats release considerable amounts of VOCs. Intermediate coats based on waterborne resins have been developed to decrease VOC emission and are already being used in some automotive plants. Basecoats, as part of base-clear topcoat systems, contain very high amounts of volatile organic solvents. Waterborne basecoats were developed more recently to lower this source of solvent emission. Some car manufacturers are operating pilot lines with the aim of introducing waterborne basecoats into their production processes. Many car producers in the United States and Europe have already switched their topcoat lines over to waterborne basecoats [11.3].

Pretreatment. Various metals are used for manufacturing car body shells: steel, galvanized steel, aluminum alloys, and zinc-rich precoated steel. The surfaces of these metals are routinely contaminated with oils, drawing lubricants, dirt, and assembly residues (e.g., welding fumes). The body shells are pretreated to remove these contaminants and to obtain a well-defined, homogeneous surface that has the necessary properties for adhesion of primers. Pretreatment includes surface cleaning and formation of a phosphate conversion coat on the shell surface (see Section 8.2.1); six to nine discrete steps are involved using either spraying devices or baths. Continuous control of phosphating solutions ensures good results [11.1], [11.4].

Anticorrosive Primers. Anticorrosive primers are applied in dip tanks so that they reach all parts of the car body; dipping is a fast method of application. The standard method for application of primers is electrodeposition. Anodic electrodeposition paints were used when the electrocoating technique was first applied, but cathodic electrodeposition is now predominant because it provides better corrosion protection.

The binders for cathodic electrodeposition are epoxy resin combinations dispersed in water (see Section 3.8). Advantages of anticorrosive electrocoatings include excellent corrosion resistance at a dry film thickness of ca. 20–30 μm . Electrocoats are stoved at 165–185°C to obtain films with the desired properties. The paint industry is now developing electrocoats that can be cured at lower temperatures (140–150°C). Electrocoating produces a homogeneous film that covers the entire car body surface, including recesses and cavities.

Although the dry film thickness on the metal edges is somewhat lower, these areas are still efficiently protected against corrosion. The ultrafiltration technique results in a very high transfer effect and a uniform coating: paint solids from the bath are deposited on the metal surface without loss. Since electrodeposition paints have a low organic solvent content, air pollution is low. The dip tank contents are not flammable, which reduces insurance costs [11.5].

Intermediate Coats. Intermediate coats (fillers) are applied between the anticorrosive primers and the topcoat systems. They provide good filling and flowing layers which are normally smoothed by sanding. Oil-free polyesters are used as binders for fillers. They react with blocked isocyanates in 20 min at 165°C. Their high flexibility gives the whole coating system a highly effective mechanical (stone chip) resistance.

Fillers are applied with electrostatic spraying devices (fast-rotating bells) to give dry film thicknesses of about 40 μm . Waterborne fillers with polyester-melamine binders (primer surfacers) have been developed to reduce the volatile organic content. They yield a film thickness of 30 μm after a prereaction time of 10 min at 100°C and a reaction time of 20 min at 165°C. The properties of the films are similar to those formed by solventborne paints. More recently, waterborne fillers based on blocked isocyanates have been developed. Field trials have shown that their mechanical resistance is very good.

Topcoat Systems. Topcoats form an important part of the protection system of the car body surface, but are much more important for decoration. The basic requirements for a car topcoat are:

- 1) Full, deep gloss (wet-look)
- 2) Highly brilliant metallic effects
- 3) Long-lasting resistance against weather and chemical influences
- 4) Easy to polish and repair

Topcoats based on nitrocellulose combinations with plasticizers and alkyd resins were used in the first decades of industrial car manufacturing. These were followed by thermosetting alkyd-melamine combinations, and later by thermosetting acrylics. The use of stoving enamels as thermosetting paints also accelerated production significantly. Although the properties of these coatings during application and in use were very good, their high content of volatile organic solvents had to be lowered to comply with legal restrictions.

The basecoat-clearcoat system is presently the most commonly used type of topcoat for cars because it is the standard application system for metallic colors. Today, about 70% of all cars have metallic topcoats. The basecoat-clearcoat system consists of a colored layer (basecoat) which is overcoated after a short flash-off time with a protective layer of clearcoat. Both coats are cured together at 120–140°C. The basecoat contains pigments which provide two types of finish: solid (straight) colors or metallic.

Solventborne metallic basecoats contain ca. 15% solids and ca. 85% volatile organic solvents. These solvents are not released into the atmosphere, but are converted to combustion gases in afterburners. To reduce emission of organic solvents from this source, waterborne basecoats have been developed.

Waterborne basecoats with higher solids contents are now available: metallic basecoats contain about 18 wt % solids and solid (straight) color basecoats 25–40 wt %. The solvent in waterborne paints is not pure water; about 15% of organic solvents is still needed as a cosolvent for proper film formation. Metallic basecoats are applied at a DFT of 15 µm, solid color basecoats at a DFT of 20–25 µm.

Basecoats are sprayed in two layers. The first layer is sprayed electrostatically with high-speed rotation bells, the second layer is sprayed with compressed air to achieve proper orientation of the aluminum particles in metallic paints. The basecoat is then dried for 3–5 min in a warm air zone at 40–60°C.

A final layer of clearcoat is applied with electrostatic high-speed rotation bells [11.3], [11.7]

to protect the system against atmospheric influences, including wear and tear during use.

Alkyd-melamine clearcoats with an approximate solids content of 50% contain UV-absorbing agents to prevent deterioration in extreme climates.

Some car manufacturers use clearcoats with acrylic binders that are cured with aliphatic isocyanates. Their chemical and mechanical properties are better than those of alkyd-melamine clearcoats. Solid contents are as high as 58%.

Car Repair Paints [11.1]. Repair paints are used in considerable amounts for refinishing cars. Since repair shops cannot provide the same facilities as those of car manufacturers, repair paints are dried at ambient temperature or elevated temperature up to 80°C (metal temperature). Alkyd repair paints and nitrocellulose paints were standard materials, but two-pack acrylate-isocyanate refinish paints are now more common. Their properties are similar to those of the original car coatings (long-lasting gloss and color, mechanical and fuel resistance). Car refinish paints are available in a wide range of colors, solids as well as metallics. They are often supplied to shops and retailers as mixing schemes.

Paint systems for car repair comprise anticorrosive primers, putties, intermediate coats, and topcoats; repair coatings applied to refinished cars have similar durabilities to those of the originally manufactured coating systems.

11.2.2. Other Automotive Coatings

The properties of coating systems used for car components differ considerably from those of systems used for exterior car surfaces. Color is not important (and is mainly black or gray), but anticorrosive properties similar to those of car body coatings are required. Since car components are produced in large numbers, coatings are commonly baked at high temperature to ensure a high reaction rate and rapid film formation.

Wheels are electrocoated; engine blocks are coated with heat-resistant, usually waterborne materials. Other parts (e.g., steering equipment and shock absorbers) are painted with two-pack, one-coat epoxy systems that are usually solventborne; use of waterborne systems is, however, increasing.

**This Page is Inserted by IFW Indexing and Scanning
Operations and is not part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ **BLACK BORDERS**
- ☐ **IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**
- ☐ **FADED TEXT OR DRAWING**
- ☐ **BLURRED OR ILLEGIBLE TEXT OR DRAWING**
- ☐ **SKEWED/SLANTED IMAGES**
- ☐ **COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- ☐ **GRAY SCALE DOCUMENTS**
- ☐ **LINES OR MARKS ON ORIGINAL DOCUMENT**
- ☐ **REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**
- ☐ **OTHER:** _____

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.